

## UNITED STATES PATENT OFFICE

GEORGE N. SIEGER, OF RUTHERFORD, AND JOSEPH A. WEIGER, OF UNION CITY, NEW JERSEY, ASSIGNORS, BY MESNE ASSIGNMENTS, TO P. R. MALLORY & CO. INCORPORATED, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA

## METAL ALLOY

No Drawing.

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This invention relates to metallic bodies comprising metallic mixtures which are frequently termed alloys and are adapted for use as contacting electrodes in electric welding and the like.

It is an object of the invention to provide an improved alloy capable of use in numerous different associations, but primarily adapted for employment as an electrode for use in welding operations.

It is a further object of the invention to provide an improved, novel and commercially desirable method of producing an alloy or electrode of the character aforementioned.

Another object is that of providing an alloy as aforementioned which will efficiently perform the purposes for which it is intended and may be economically and readily manufactured.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the constructions hereinafter set forth and the scope of the application of which will be indicated in the claims.

With primary reference to the alloy, it is preferred to utilize a refractory metal combined with metal having a relatively low melting point, it being also desirable to incorporate in the alloy a material increasing the inherent hardness thereof to a marked extent.

According to the present invention, the refractory metal may include one of the elements of the sixth group of the periodic table of chemical elements, sub-group for example, chromium, molybdenum, tungsten and uranium, as specified in the Mendeléeff's table appearing in "Treatise on Chemistry", by Roscoe & Schorlemmer, Vol. II "The Metals", published by The MacMillan Publishing Company. Combined with a base of this nature in a manner hereinafter specified are one or more metals having a relatively low melting point, such as for example, aluminum, tin, antimony, zinc, nickel, magnesium, lead, copper, and manganese, etc. Any desirable

hardening material may be incorporated in the alloy, as for example, carbon or lamp-black, which may be combined with the base, and phosphorus may be utilized, if desired, combined with the low melting point metal, in order to harden the same. The amount of this hardening material should be present in an amount of not more than about 3 per cent by weight of the refractory metallic base.

An alloy of this nature may be employed to advantage in numerous associations, but as aforebrought out, it is particularly desirable in welding operations. It has been found where spot-welding is to be resorted to that the refractory metal may be solely molybdenum or this metal combined with another of the group afore-specified, for example, tungsten. Where pressure welding is being undertaken, the refractory metal preferably is tungsten.

A suitable combination of these materials may be as follows:

|                              | Per cent<br>by weight |
|------------------------------|-----------------------|
| Refractory metal.....        | 72                    |
| Low melting point metal..... | 27.5                  |
| Hardening material.....      | .5                    |

By combining a refractory metal with a metal having a low melting point, it is found, first, that the resulting alloy is rendered inherently strong, and its texture is homogeneous. Secondly, such an alloy will be capable of being readily machined. Thirdly, the heat conductivity thereof will be of proper grade; and fourth, the electrical conductivity will be improved.

By the introduction of lamp-black or a similar material into the base, corresponding carbides are formed and the base will have its inherent hardness considerably enhanced. In other words, by this expedient it might be said that the structure of the base is changed into a material which is fundamentally harder or that the actual composition thereof is changed, and if the alloy is utilized as an electrode its base will have the property of not adhering to the material being welded (which would be the case with pure tungsten).

By the use of such an electrode, a practicable method is developed of spot-welding

heat-metals having relatively low melting points, for example brass since in the first place the electrode will not adhere or fuse to the brass, and in the second place the resistance offered by the same will be sufficient for supplying the requisite amount of heat.

Thus an alloy is provided by means of which welding operations may readily be performed, which were heretofore of an extremely delicate or somewhat impracticable commercial nature, in that they caused a breakdown on the part of the contact elements or electrodes, which will not be the case when employing electrodes of the nature embraced by the present invention. The following is an example of the method of producing an alloy in accordance with the present invention:

Quantities of the refractory and hardening ingredients taken for example in the amounts indicated above, i. e. 72 parts by weight of tungsten, as the refractory material (the 27.5 parts by weight of the low melting point metal, such as copper, being later added), and .5 parts by weight of lamp black as the hardening material, are mixed together preferably in powdered form and an ingot is formed by subjecting the same to pressure, for example ten pounds to the square inch. The latter is fired in a hydrogen furnace at 1000° C., and continued for a few minutes. In the ingot the voids will amount to 40% to 50%, so that theoretically and practically the limit of additional material will be approximately equal. The metal is then placed in a refractory receptacle, and the low melting point metal is placed preferably in solid form about it. The whole is then further heated in a reducing atmosphere, and the low melting point metals will penetrate the base and form a good alloy. Thus with metal, which melts at 1080° C., the temperature of the ingot is raised to approximately 1300° C. and maintained at this temperature for approximately one hour, after which it is allowed to cool. If the resulting alloy is reheated to the same temperature, it will be found that none of the low melting point metal will flow from the base.

By means of the present method, excellent alloys are obtained, the structure of which is homogeneous, and the bodies of which may be easily prepared, and where such alloys are utilized to provide the bodies of electrodes the latter may be employed to advantage over long periods of time without any breaking down of their structure, and they may also be utilized for the ready practicing of welding methods heretofore regarded as impracticable.

Thus, among others, the objects specifically aforementioned are achieved, and since certain changes in carrying out the above process and certain modifications in the composition which embody the invention may be made

without departing from its scope, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which as a matter of language might be said to fall therebetween. Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A metallic body comprising, in preponderating amount, a porous base of metallic tungsten with which is incorporated a relatively low melting-point metal comprising copper, and a hardening material comprising one or more of the elements carbon and phosphorous in an amount up to about 3 per cent by weight of the base adapted to react with the metallic tungsten and partially harden the same.

2. A metallic body comprising, in preponderating amount, a porous base of metallic tungsten with which is incorporated a relatively low melting-point metal comprising copper and a hardening material comprising carbon in an amount up to about 3 per cent by weight of the base adapted to react with the metallic tungsten and partially harden the same.

3. A metallic body comprising, in preponderating amount, a porous base of metallic tungsten with which copper is incorporated in a ratio approximating substantially three to one, and a hardening material comprising carbon in an amount up to about 3 per cent by weight of the base.

4. A metallic body comprising a porous base of one or more of the metals of the sixth periodic group, sub-group A in Mendeléjeff's periodic table of the elements, with which is incorporated a relatively low melting point material comprising one or more of the metals aluminum, tin, antimony, zinc, nickel, magnesium, lead, copper and manganese, and an agent comprising one or more of the materials carbon and phosphorous which is present in an amount up to about 3 per cent by weight of the base adapted to react with the material of the porous base and partially harden the same.

5. A metallic body comprising, in preponderating amount, a refractory metallic base of one or more of the metals of the sixth periodic group, sub-group A in Mendeléjeff's periodic table of the elements, with which is incorporated a relatively low melting point material comprising copper and a hardening material comprising carbon in an amount less than about 3 per cent by weight of the base.

6. A metallic body comprising, in preponderating amount, a porous tungsten base, with which is incorporated a relatively low melt-

ing point metal comprising one or more of the metals aluminum, tin, antimony, zinc, nickel, magnesium, lead, copper and manganese, and carbon, the carbon being present in an amount up to about 3 per cent by weight of the base.

7. A metallic body comprising a porous base of partially carburized tungsten, and a relatively low melting point constituent comprising copper impregnating said porous base, said carburized portion of said base including a carburizing material in an amount not greater than about 3 per cent by weight of the base.

8. A metallic body comprising a porous base of partially carburized tungsten and copper impregnating said base, said carburized portion of said base including a carburizing material of lamp black in an amount up to about 3 per cent by weight of the base.

9. A metallic body comprising a porous base of one or more of the metals tungsten and molybdenum, a relatively low melting point constituent comprising copper, and carbon in an amount up to about 3 per cent by weight of the base, said carbon being adapted to react with the material of the porous base and harden the same.

10. A metallic body comprising a porous base of partially carburized tungsten and copper impregnating said base, said carburized portion of said base including carbon in an amount of about .5 per cent by weight of the body.

In testimony whereof we affix our signatures.

G. N. SIEGER.  
JOSEPH A. WEIGER.